CLAIMS

1. A method for fabricating, modifying or repairing of single crystal (SX) or directionally solidified (DS) articles (1), the method comprising the steps of
   (a) joining of two single crystal (SX) or directionally solidified (DS) prefabricated parts with matched crystallographic orientation by isothermally brazing using a brazing material,
   (b) applying a layer (12) on the surface (5) of the article (1) and of the braze joint (22) using a laser metal forming process, thereby
   (c) moving a light source and a signal capturing apparatus and the article (1) relative to each other, thereby
   (d) melting locally the surface (5) of the article (1) or of the braze joint (22) using the light source with a specific power for forming a melt pool (7),
   (e) injecting powder (8) with a carrier gas (9) or a wire into the melt pool (7).
   (f) capturing an optical signal (13) from the melt pool (7) using the signal capturing apparatus,
   (g) using the monitored optical signal (13) for the determination of temperature and temperature fluctuations as properties of the melt pool (7),
   (h) using the information of the temperature and temperature fluctuations of the melt pool (7) from the optical signal (13) within a control system (16) in a feedback circuit to adjust as process parameters one or a combination of the power of the light source, the relative speed between the light source and the article (1), the mass feed rate of the added material and/or of the carrier gas (9) such that desired melt pool properties are obtained and subsequently
   (i) solidifying the melt pool (7).

2. The method according to claim 1, comprising the step of adjusting the melt pool (7) properties to obtain epitaxial material build-up with thermophysical properties of the deposit matched to those of the article (1) and of the braze joint (22).

3. The method according to claim 1, the laser deposited material solidifies non-epitaxially with the underlying material.

4. The method according to any of the claims 1 to 3, comprising the step of applying a coating (12) on the surface (5) of the article (1) and of the braze joint (22) using the laser metal forming process.

5. The method according to any of the claims 1 to 3, comprising the step of mixing multiple powder compositions and supplying the mixture concurrently to the melt pool (7) during the laser metal-forming process.

6. The method according to any of the claims 1 to 3, comprising the step of using different powder compositions at different regions for the application of the laser deposited layer (12) of the surface (5) of the article (1) or of the braze joint (22).

7. The method according to any of the claims 1 to 3, comprising the step of determining the crystallographic orientation of the prefabricated parts and joining the parts together so as to create a low angle boundary.

8. The method according to any of the claims 1 to 3, comprising the step of repairing gaps (20) or cracks of an article (1) by the method of claim 1.

9. The method according to claim 8, comprising the step of repairing gaps (20) of an article (1) by the method of claim 1 thereby using a brazing insert (21).

10. The method according to claim 9, comprising the steps of using a brazing insert (21) which has the same crystalline orientation as the article (1).

11. The method according to claim 9 or 10, comprising the step of preparing the brazing insert (21) from used gas turbine articles before carrying out the method.

12. The method according to any of the claims 8 to 11, comprising the step of cleaning gaps (20) or cracks from unwanted oxides before the application of the method.

13. The method according to any of the claims 9 to 11, wherein the brazing is done under vacuum or any preferable and suitably controlled atmosphere.

14. The method according to any of the claims 1 to 3, comprising the adjusting of the parameters of the epitaxial laser metal-forming step such that melt pool properties are obtained to avoid columnar to equiaxed transition (CET) during solidification of the melt pool (7).

15. The method according to any of the claims 1 to 3, comprising the adjusting of the process parameters of the epitaxial laser metal-forming step such that melt pool properties are obtained to avoid convection in the melt pool (7).